My Tummy Hurts:
Differentiating Pediatric Abdominal Pain Requiring a Surgical Consult

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Disclosures

- None

Learning Objectives

- Identify key differences in the history of pediatric patients with abdominal pain.
- Identify physical exam findings pertaining to surgical etiologies of pediatric abdominal pain.
- Choose the appropriate diagnostic imaging and laboratory tests to aid in the diagnosis of pediatric abdominal pain.
- Recognize common causes of pediatric abdominal pain necessitating surgical treatment.

3 day old female

- Born at 37 weeks, C Section
- Mom received prenatal care
- No pre natal or post natal complications
- Went home on day 2 of life
- This morning was more fussy
- Started having “spinach green” spit up

Key Finding

- Started having “spinach green” spit up
- Until proven otherwise, bilious emesis in a newborn is malrotation with volvulus

History

- Classic newborn presentation symptom:
- Bilious vomiting
- Other symptoms in newborn: pain, irritability, other nonspecific symptoms (anorexia, nausea, failure to thrive, change in stooling patterns)

History

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- Bilious vomiting
- Other symptoms in newborn: pain, irritability, other nonspecific symptoms (anorexia, nausea, failure to thrive, change in stooling patterns)

History

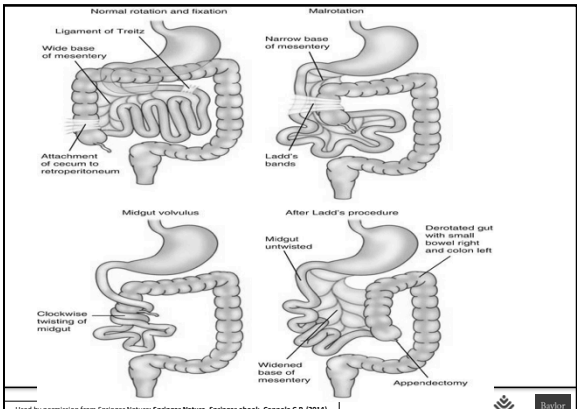
- In older patient
- Less likely to have bilious vomiting
  - Recurrent episodes of unexplained abdominal pain, irritability, vomiting
  - Failure to thrive

Prevalence & Presentation

- In infants under 1 year – 3.9 per 10,000 live births
- 75 - 80% present within the 1st month of life, 90% present within the first year

Malrotation

- Failure of normal sequence of rotation and fixation in bowel
- Congenital abnormal rotation of the bowel – usually small and large – within the peritoneal cavity



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Malrotation and Volvulus / Obstruction

- Malrotation leads to a predisposition for volvulus / obstruction
- Compression from bands from cecum to lateral abdominal wall (Ladd's bands)
- Small bowel volvulus – can lead to ischemia of the midgut from SMA occlusion

Risk Factor

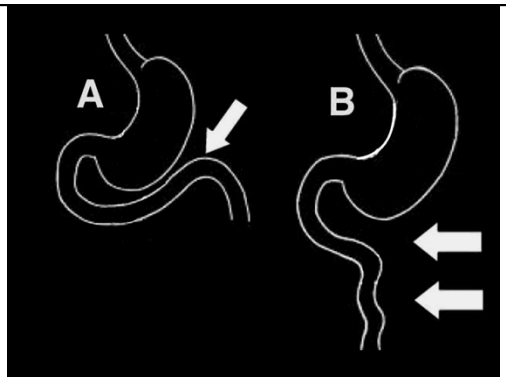
- Heterotaxy Syndrome

Physical Exam

- +/- hemodynamic instability
- Hydration status – mucous membranes, fontanels
- +/- abdominal distension
- +/- abdominal tenderness
- +/- peritonitis

Imaging

- Gold Standard: Upper GI
  - Can give contrast via PO or NG tube
  - Critical landmark – duodenal jejunal junction



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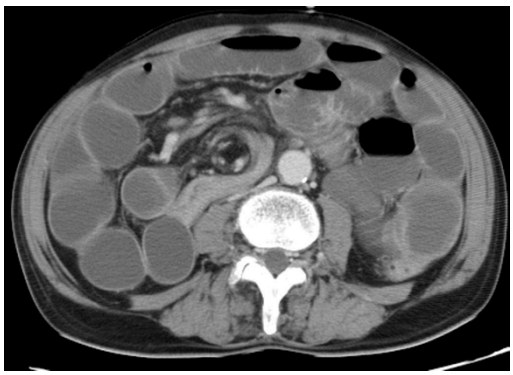
Case courtesy of A. Prof Frank Gaillard, rID8029, Radiopedia.org

Imaging

- KUB – can be normal or abnormal
- US or CT - reversal of normal SMA and vein relationship – with midgut volvulus “whirlpool sign”



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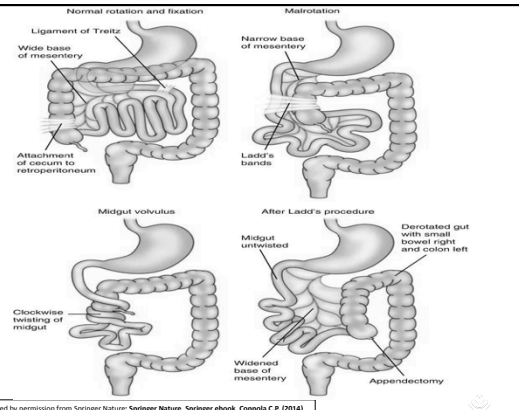
Surgical Consult

- Needs emergent surgical treatment to prevent bowel death / rupture
- Definitive treatment – Ladd's procedure
- Keep NPO
- Start on fluids



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3yo male

- Has abdominal pain and then it goes away for a while
- Curls into a ball when it is happening
- 2 episodes of diarrhea
- Recent runny nose / cough – parents thought it was a cold or allergies

Intussusception Presentation

- Classic Triad
  - intermittent abdominal pain
  - Red current jelly stools
  - Palpable abdominal mass
- Occurs in less than 20% of patients

Presentation

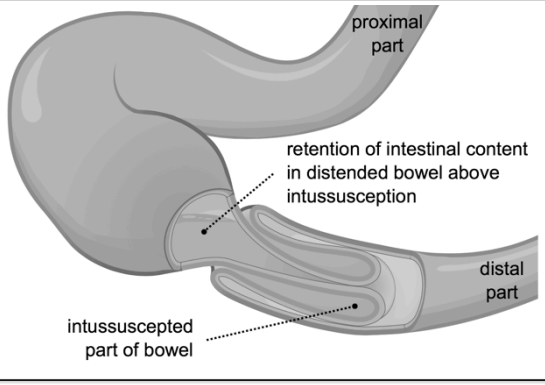
- Classical Presentation
  - Young Child
  - Recent Viral Illness
  - Intermittent abdominal pain – drawing knees to chest
  - Vomiting / Diarrhea
  - Palpable abdominal mass

Presentation

- In differential for patients with: intermittent abdominal pain, vomiting, bloody stools, palpable abdominal mass, lethargy, altered mental status

Intussusception

- Common cause of bowel obstruction in children
- Segment of bowel (intussusceptum) invaginates into the distal bowel (intussuscipiens)



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Intussusception

- Compresses Vessels
  - Initially – venous congestion, bowel wall edema

Intussusception

- Compresses Vessels
  - Eventually – can compromise arterial blood supply – intestinal ischemia, bowel necrosis, bowel perforation

Epidemiology

- Usually infants / toddlers
- Males 2-3x more frequently than females

Pathophysiology

- Usually ileocolic
- Can be small bowel / small bowel

Primary Idiopathic Intussusception vs Secondary Intussusception

Primary Idiopathic Intussusception

- Idiopathic – 90% of pediatric intussusception
- Usually following a viral illness – URI – more frequent in spring / autumn
- Viral illness causes hypertrophied lymphatic tissue in bowel wall
- More cases of idiopathic intussusception in kids under the age of 2

Secondary Intussusception

- 2% of cases
- Identifiable lead point
  - Anatomic: Meckel's diverticula, appendicitis
  - Tumors – lipomas, lymphomas, etc
  - Genetic – Cystic fibrosis, hamartomas from Peutz-Jeghers
  - Infectious
  - Vascular
  - Traumatic
  - Foreign Body
  - Post surgical

Secondary Intussusception

- Risk increases after age 3
- Most common Pathologies:
  - Meckel's diverticulum
  - Lymphoma
  - Polyps

Timeline of presentation

Symptom	Early Onset	Late Presentation
Vitals	Stable	Shock presentation
Emesis	Non bilious	Bilious
Abdominal Exam	Normal – possible sausage shaped mass	Tender, distended, peritonitis
Stools	No change	Red bloody

Physical Exam

- Abdominal exam
  - Can be normal between episodes
  - Peristaltic rushes
  - Sausage shape abdominal mass – usually in RUQ
  - Dance sign – flat appearance or emptiness in RLQ

Diagnostic Studies

- Labs
  - CBC and Chemistries helpful but not indicative
  - Guiac + or -

Diagnostic Studies

- Ultrasound
  - Imaging modality of choice – sensitive, specific, decreased cost, no radiation
  - Operator dependent
  - Target sign – transverse plane – mesenteric fat and bowel wall telescoping
  - Pseudokidney sign – longitudinal plane

Case courtesy of Dr Behrang Amini , Radiopaedia.org, rID: 3456

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Other Imaging

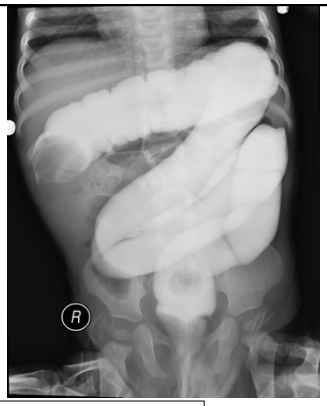
- Abdominal Xray – ½ of patients will have an observable mass or an obstructive gas pattern
  - Always check for free air
- CT
  - Provides diagnosis, but expensive and high radiation

Contrast Enema

- Can be used as both a diagnostic and therapeutic treatment – however, includes risk of radiation

Surgical Consult

- If patient stable – nonoperative reduction with radiology
  - Pneumatic enema
  - Hydrostatic enema
- If patient unstable or nonoperative reduction fails – to OR for surgical reduction



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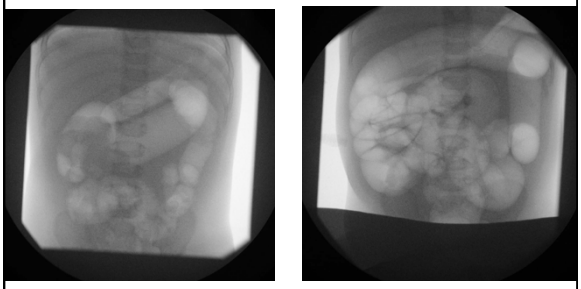

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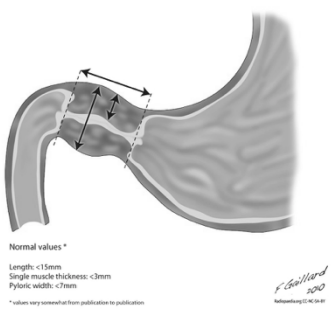
4 week old male

- Full term
- Initially gaining weight well
- Started to have significant spit ups
- Diagnosed by PCP with milk protein allergy
- Has been on 5 different formulas
- Continue to throw up with every feed
- Losing weight, urinating less

4 week old male

- Physical exam
  - Fontanels sunken
  - Skin and mucous membranes dry
  - Benign abdominal exam



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Pyloric Stenosis

- Infantile hypertrophic pyloric stenosis
- Enlargement / thickening of the pyloric muscle

Pyloric Stenosis

- Epidemiology
  - Occurs in 2-4 per 1000 live births in the West
  - Boys 4x more likely than girls

Pyloric Stenosis

- Presentation
  - Usually between 3-10 weeks
  - Nonbilious nonbloody emesis
    - Textbook - projectile
  - Wide initial differential
    - Overfeeding, gastroesophageal reflux, milk protein allergy, intestinal rotational anomalies, obstruction
  - Eventual weight loss, dehydration
  - Increased fussiness

Pyloric Stenosis

- Physical Exam
  - Hydration status

Pyloric Stenosis

- Physical Exam
  - Abdominal exam
    - "The Olive Sign" – to adequately palpate this can take upwards of 20 minutes
      - Best done when resting or sleeping, so that abdominal wall is completely relaxed
      - Consider using a pacifier with sweeties
      - Flex hips / lift up legs

Pyloric Stenosis

- Labs
  - Chemistries – metabolic alkalosis
    - Low Chloride
    - High Bicarb

Pyloric Stenosis

- Imaging
  - Ultrasound
    - Looking at length of pyloric channel and thickness of pyloric muscle – Channel > 15mm long, Muscle > 3mm thick
    - Target sign in transverse view
    - Nipple and cervix signs

Case courtesy of Dr. Prashant Mudgal,rID:22203, Radiopedia.org
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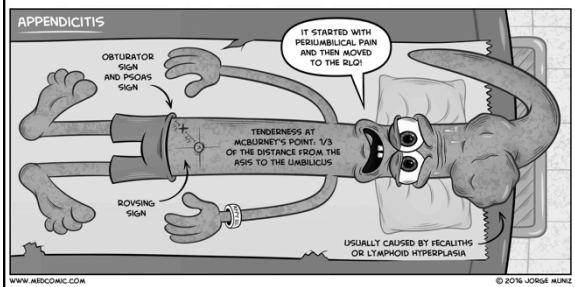
Surgical Consult

- Remember – this is a medical emergency not a surgical one
- Hydrate hydrate hydrate
- Definitive treatment – pyloromyotomy (laparoscopic vs open)

8 yo female

- 2 day history of abdominal pain
- Initially mom thought it was the stomach flu – has history of a sick classmate earlier in the week
- Pain has continued to grow worse
- Patient has not eaten in 24 hours
- When asked where pain is states “everywhere”
- When asked to point with one finger where pain is the worst – points at RLQ

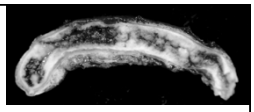


Jorge Muniz PA-C, Medcomic.com

Appendicitis

- Most common pediatric abdominal surgical emergency
- Peak incidence – 2nd decade
- Male : Female 1.4 :1
- Increased presentation in summer months
  - Increased perforation in winter months

Pathophysiology



- Obstructed appendiceal lumen
- Distension cause increased intraluminal pressure
- Stimulation of the 8th – 10th visceral afferent thoracic nerves = periumbilical pain
- Pressure increases – tissue ischemia, mucosal compromise, transmural inflammation
- Inflammation to parietal peritoneum – localized pain – fever / nausea / emesis / anorexia

Image By Ed Uthman from Houston, TX, USA - Acute Appendicitis, CC BY 2.0, https://commons.wikimedia.org/w/index.php?curid=1656138

Appendicitis

- History
  - Kids are poor historians
  - In pediatric patient, most telling sign - initial periumbilical pain migrating to RLQ
  - Under age 3 – increased risk of perforation

Appendicitis

- Physical Exam
  - Tenderness to palpation and guarding in RLQ
  - Hypoactive bowel sounds
  - Percussive and rebound tenderness

Appendicitis

- Physical Exam
  - Rovsing – palpate LLQ – positive when patient feels referred pain in RLQ
  - Obturator – pain with internal rotation of right hip when flexed at knee and hip
  - Psoas – positive if pain with extension of right hip

Appendicitis

- Labs
  - CBC
    - Elevated WBC
    - Left shift
  - CMP

Appendicitis

- Scoring Systems
  - Alvarado
  - Pediatric Appendicitis Score (PAS)

Appendicitis

- Scoring systems – Pediatric Appendicitis Score (PAS)

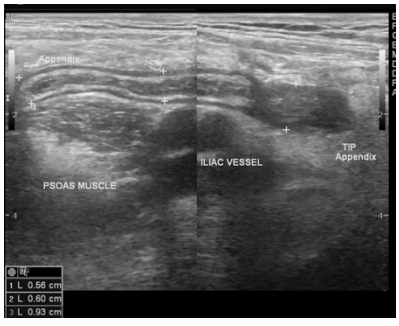
Migration of Pain	**1**
Anorexia	1
Nausea / Vomiting	1
RLQ tenderness	2
Cough / hopping / percussion tenderness in RLQ	2
Increased in temperature	1
Leukocytosis (> 10,000)	1
Polymorphoneuclear Neutrophilia > 75%	1
Total	10

Appendicitis

- PAS Score
  - Sensitivity – 97%
  - Specificity – 97.6%
  - Scoring
    - 1-3 negative for appendicitis
    - 4-7 further diagnostic studies required
    - 8-10 appendicitis

Imaging

- US
  - Increased diameter
  - Wall thickening
  - Irregular wall – rigid / non-compressible
  - Absence of air in appendiceal lumen
  - Periappendiceal fat stranding
  - Appendicolith
  - Free Fluid



Case courtesy of Dr Maulik S Patel, Radiopaedia.org, rID: 16327

Imaging

- CT
  - Oral and IV contrast are the gold standard

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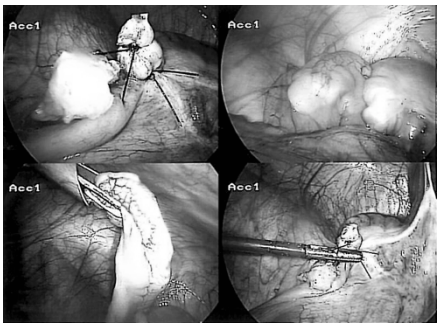
Surgical Consult

- Immediately start on antibiotics – hydrate – pain control
- Definitive treatment – appendectomy (laparoscopic vs open)
- If abscess present – possible IR drainage of abscess, followed by antibiotics and then interval appendectomy



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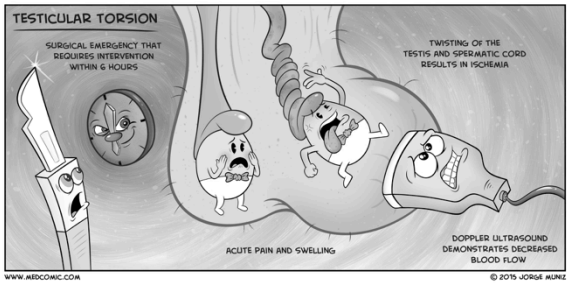
13 yo male

- 5 hours, severe RLQ pain
- Emesis x 1
- Normal abdominal ultrasound (no appendicitis)

13 yo male

- Physical Exam
  - Benign abdominal exam
  - GU exam
    - Erythematous, edematous right testicle
    - Horizontal lie
    - No cremasteric reflex



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Testicular Torsion

- Twisting of the spermatic cord resulting in compromised venous and arterial flow
- Eventually can lead to irreversible testicular damage – loss of testicle
- Diagnosis within 6 hours for viability of the testicle

History

- Sudden onset scrotal pain – usually less than 24 hours
- Also can present as abdominal pain

Physical Exam

- Ideally patient supine with knees opened laterally (butterfly)

Physical Exam

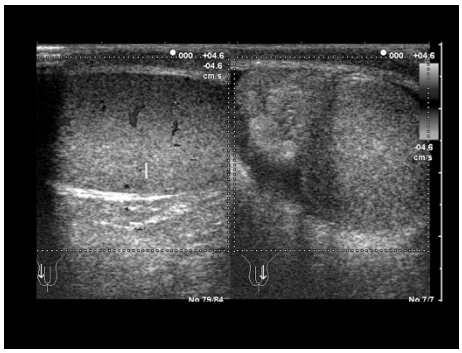
- Scrotal swelling
- Horizontal lie of testicle
- Erythema
- Tenderness on palpation

Signs and Symptoms

- Loss of Cremasteric reflex – lightly touch the inner thigh and look for retraction of the testicle
- Negative Phren's sign – no improvement of pain with elevation of testicle

Imaging

- Diagnosis made by color Doppler ultrasound



Case courtesy of Dr Fakhry Mahmoud Ebouda, Radiopaedia.org, rID: 28674

Surgical Consult

- Immediately to OR for testicular de-torsion, orchiectomy vs orchiopexy, and contralateral orchiopexy

Case courtesy of Dr Maulik S Patel, Radiopaedia.org, rID: 74016

Questions ?

Contact Information
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